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by

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Preface

The two nuclear tests conducted by India on 11 and 13 May 1998 took the world by surprise. Most observers wondered at the Indian perception of her security environment that forced her into overt 'nuclearization'. The debate immediately after the tests ranged from the causes of the tests to alteration in the regional and global security environment that the tests caused to the lack of a declared Indian nuclear doctrine. After the National Security Advisory Board of India released its draft report on the Indian nuclear doctrine the debate has shifted to the issue of how this nuclear doctrine will take shape. This research paper is a part of the ongoing debate that will finally shape the Indian nuclear doctrine and posture. Specifically, I have discussed the emergence of the Indian nuclear program and the deterrence posture that the Indian draft nuclear doctrine has proposed. Finally, I have attempted to estimate the number and type of nuclear weapons and missiles, that India will need to develop and deploy, in order to achieve this deterrence posture.

Numerous historical narratives of the Indian nuclear journey from the mid 1940s to the 1998 tests (Pokhran-II) are available. However, despite the fact that the issues of Indian nuclear posture have always generated considerable international interest especially among the non-proliferation group, most Western, post-Pokhran-II commentaries expressed surprise at the Indian decision to conduct the tests. The timing of the tests, coming at the juncture when the non-proliferation efforts had supposedly

been at their strongest with the indefinite extension of the Non Proliferation Treaty (NPT) and proposal of the Comprehensive Test Ban Treaty (CTBT), added to the international disbelief of the Indian decision. In this respect I have two points to make. Firstly, decisions of such magnitude and impact in the history of a country, as nuclear weaponization, are not based on uni-dimensional factors but are arrived at by the interaction of a combination of dynamic, historical, political, security, and personality factors. While a single event may precipitate the final act, the process, in case of every nuclear weapon state, has been that of deliberate debate and consideration. Such has also been the case with India. This aspect gives a certain national understanding and character to the nuclear program, peculiar to the individual case, which in turn directly affects the nuclear posture that the country may adopt. Secondly, India was content with the ambiguous nature of its nuclear weapon status since it offered her adequate security without putting demands on her economy to deploy a visible nuclear force. Despite her restraint, her deteriorating security environment, a nuclear armed China across the border with unresolved territorial issues, lack of assurance of global nuclear disarmament in the foreseeable future, and renewed boost to the non-proliferation regimes that pushed India into a situation of 'use it or lose it' dilemma about her nuclear option finally forced India into overt 'nuclearization'. In the first chapter I have presented a chronological narrative of the events, issues, and Indian perceptions leading to the Pokhran-II tests. This chapter also acts as the contextual basis for my discussion in the second chapter.

In the avid debate regarding the nuclear weaponization of India, the two levels most often discussed are either in the low range of 60-130 weapons or in the high range of 300-400 weapons depending upon the source. The second chapter is a part of this debate.

In this chapter I have first defined and discussed the deterrence posture that the draft doctrine has sought. The doctrine refers to a minimum credible deterrence with an aim to deter the use and threat of use of nuclear weapons against India. It proposes a 'retaliation only' policy and triadic forces to ensure adequate survivability. I have argued that the deterrence in the Indian scenario can be achieved by a non-provocative, 'existential' rather than a strictly 'minimal' posture since it is not country specific and can rest more on the ambiguity of the response than on an overtly aggressive posture. Having discussed these factors I have estimated the number of weapons and missiles required to achieve the proposed conditions. I have selected a countervalue target set of top ten cities of a hypothetical industrial nation and defined the 'unacceptable damage' criterion in terms of the percentage of population at risk in case of a nuclear attack on these cities. I have made some assumptions, based on earlier authoritative works of similar nature, wherever accurate information was not available due to its classified nature. Considering that only material available from open sources has been included in the present calculations the conclusions are representative rather than specific. Within these limitations, it was found that India needed to develop and deploy 165 nuclear weapons of 50 kilotons (KT) yield, 70 weapons of 20 KT yield, 200 Agni 2/3missiles, and 35 Prithvi 2/3 missiles to achieve the deterrence posture sought in the draft nuclear doctrine.

As the title page of this paper notes, this research started only as a 'partial fulfillment of graduation requirement'. However, through the constant guidance, encouragement and inspiration from my advisor, Wg Cdr Steven Cockram, it finally developed into a personal quest of knowledge on the issues and concerns about the most destructive weapon man has known and their utility in the Indian scenario. In that sense, if this

research has reached a useful form and if it serves to generate more thought, debate, and research on the subject the credit must almost entirely go to Wg Cdr Cockram. My thanks are also due to him for his patience through the muddled initial drafts which he painstakingly assisted in bringing up to the present standards. I must acknowledge the assistance I got from the staff of the Air University Library, which formed the font source of all the information used in the research. I must also convey my gratitude to the Air University that provided me the opportunity to undertake this project. If this first attempt at, what may be termed as, picking shells on the beach of the ocean of knowledge results in future ventures into deeper waters the university would have achieved the fundamental aim of education. Finally, any mistakes, errors, or omissions in the research and the paper are due entirely to me.

Abstract

India started its nuclear research with the sole purpose of utilizing nuclear power for its technological and industrial growth. However, despite her moral dilemmas and restraint demonstrated since her first test of a peaceful nuclear explosive (PNE) in 1974, a variety of factors led to India's two nuclear tests on May 1998. In the wake of these tests National Security Advisory Board of India issued a Draft Report on Indian Nuclear Doctrine. The draft doctrine suggests that India intends to develop and deploy nuclear weapons based on the triad of platforms. The nuclear forces, however, are sought only to be minimum possible to credibly deter nuclear weapons use or coercion against India. Considering the imperatives of the Indian deterrence posture as per the draft doctrine, and the state of her weapons and missile program an estimate of the number and type of weapons and delivery systems has been made. The information used in arriving at the conclusion is from unclassified sources. A countervalue target set of top ten cities of a hypothetical country is selected. Assumptions have been made, using other such authoritative works, wherever specific data was not available due to its classified nature. Within these limitations, it was found that India needed to develop and deploy 165 nuclear weapons of 50 KT yield, 70 weapons of 20 KT yield, 200 Agni 2/3 missiles, and 35 Prithvi 2/3 missiles to achieve the deterrence posture sought in the draft nuclear doctrine.

Chapter 1

India's Search for Nuclear Independence

Introduction

This chapter presents a brief chronological narrative of the events and issues leading to the Pokhran-II tests. The intent is firstly, to set up a contextual reference and secondly, to understand the Indian perspective of the situation which led to her overt 'nuclearization' in complete departure from her twenty-four years of deliberately ambiguous 'option strategy'. Both these factors are of importance to our discussion on the emerging Indian nuclear posture in the next chapter.

'India's underground nuclear tests on May 11 and 13 (1998) caught the world by surprise.'[1] Most commentaries on the second Indian nuclear test commence in this manner. More than surprise the sentiment expressed is betrayal. To the 'moralist' observer the twenty-four year old restraint (from Pokhran-I in 1974 to Pokhran-II in 1998) was but a thin immoral veil for India to get the adequate technological and economic capability to make the bomb. To the 'realist' observer the break up of the USSR, the superpower mentor of India, and increasing Chinese nuclear power, created a 'security dilemma'[2] such that 'only India's nuclear capabilities could elevate India to a position where it could not be subject to Chinese nuclear coercion.'[3] To the 'sensationalist' observer 'the sole purpose of nuclear weapons on the subcontinent is

genocide.'[4] And to the 'orientalist'[5] observer, since the security policies of the Third World countries 'are aimed at safeguarding the existing regime rather than the nation,'[6] it was a ploy by the ruling Hindu nationalist party[7] to strengthen its feeble public support.

It is wrong to ascribe a simple circumstantial explanation to such a momentous decision in the history of a country. Such decisions normally are arrived at by the interaction of a combination of dynamic historical, political, security, and personality factors. A study of the evolution of nuclear policies of the previous nuclear weapon states (NWS) shows similar results. Consider the emergence of the British nuclear posture. Margaret Gowing, the official British historian, believed that the decision to build the bomb was not 'a response to an immediate military threat but rather … a feeling that Britain as a great power must acquire all major new weapons, … atomic weapons are a manifestation of the scientific and technological superiority.'[8] Also 'British party leaders believed that possession of a full fledged nuclear deterrent would enable the country … to pursue policies independently of the United States,' further it would be a 'ticket to the table.'[9] In addition 'despite all outward expression of confidence in the US nuclear guarantee, the fear of American abandonment persisted.'[10] While US and British scholars believe that 'the US policy of trying to maintain a nuclear monopoly after WW II may have affected Great Britain's atomic policy more than that of Soviet Union,'[11] the impressions in France were different. 'One of the factors that influenced de Gaulle to pursue highly independent defense policies was the privileged status that the British enjoyed in Washington.'[12] For the French, 'nuclear weapons equal peace, but also independence, international rank, and living up to France's glorious past.'[13] In view of these observations is it fair, or even possible to assign uni-dimensional reasons for the

nuclear policies of the British or the French or, for that matter, the Chinese, Russians or the Americans? As Beatrice Heuser put it, 'perhaps we should turn to a dimension beyond the geophysical, the technological, the economic and narrowly political – all of which undoubtedly play an important role in determining a state's strategy.'[14]

1945 to Pokhran-I

India's independent research in the field of nuclear physics started as early as 1945. Homi J Bhabha, an Indian physicist of repute, 'convinced one of India's principal industrial barons, the Tata family, to contribute money towards the creation of a center for the study of nuclear physics.'[15] After independence, the first Indian Prime Minister, Jawahar Lal Nehru, was in turn duly convinced by Bhabha to continue funding the nuclear research program. In the early post-independence period 'Nehru's word and actions, and most important, his support of Bhabha's actions, indicate an essential duality and ambiguity that characterized India's nuclear program.'[16] On the one hand 'the moralist visionary … abhorred the wanton destructiveness of nuclear weapons'[17] but on the other he granted Bhabha 'a free hand in the development of India's nuclear infrastructure and sought to lay the necessary foundation should a political decision to acquire nuclear weapons be made.'[18]

The early 1950s saw the emergence of the first serious and constructive steps to curb nuclear proliferation. In Dec 1953, 'the year after the United States tested its hydrogen bomb and Great Britain exploded its first atomic bomb, completing the inner circle of the nuclear club,'[19] President Eisenhower proposed the Atom for Peace plan. In the negotiations, conducted during the 1950s and 1960s, Bhabha, expressing the Indian concerns of vertical proliferation, likened the safeguards proposed by the regime a system

to 'ensure that not the slightest leakage took place from the sides of a vessel while ignoring that the vessel had no bottom.'[20] By the late 1950s, the US nuclear monopoly having been broken by the Soviet and the British tests, the idea of a nonproliferation treaty was also receiving consideration. At first the US endeavors were neutralized by the Soviet Union, which 'adamantly opposed all forms of international inspection in arms control and disarmament negotiations.'[21] In 1965, 'along with a small group of non-aligned countries, India had put forward the idea of an international non-proliferation agreement under which the nuclear weapon states would agree to give up their arsenals provided other countries refrained from developing or acquiring such weapons.'[22] The idea was rejected by the NWS: firstly, on the grounds that it was impossible to verify the adherence to such an agreement; and, finally, because the nuclear powers were coming to an advanced stage of resolving their differences over the non-proliferation treaty, Soviet Union having modified its position earlier mainly out of concern for Germany, Japan, and China going nuclear.[23] However, 'many new and nonaligned nations agreed with India's representatives' who argued that what the world needed was 'a comprehensive test ban treaty, a complete freeze on production of nuclear weapons and means of delivery as well as a substantial reduction of existing stocks.'[24]

The years 1962 and 1964 became the most important in the early history of the Indian nuclear program. In 1962 China attacked the Northeastern Indian frontier, convincingly defeated her ill-equipped and ill-prepared military forces, occupied 14,000 square miles of Indian territory, and, after achieving its territorial objectives, declared a unilateral cease-fire.[25] On Oct 16, 1964 China conducted its first nuclear explosion in Lop Nor. The fact that a territorial dispute existed between China and India, wherein the

former had absorbed 10,000 square kilometers of Indian territory, illegally gifted to it by Pakistan, and claimed another 94,000 square kilometers, ensured that India could not ignore the reality of the Chinese nuclear program.[26] The Chinese views of the nuclear war, expressed in 'Mao's conversation(s) with Jawaharlal Nehru about 300 million building up a glorious Chinese civilization even if 300 million perished in a nuclear war,' was an added factor that always kept the Chinese nuclear threat in the Indian security calculus.[27] These concerns became the impetus for India's frantic, though ultimately futile, search 'for security guarantees from the United States and the USSR,' as well as Britain, 'against possible nuclear threats from China.'[28] Absent any credible security guarantees the Indian government of the day ruled in favor of pursuing a program leading to a 'peaceful nuclear explosive.'[29] At that stage Bhabha had claimed only eighteen months and Rs 17.5 Lakhs (approximately $350,000) for a 10 kiloton (KT) explosion.[30] The fact that it finally took India ten years before she could explode her first atomic device deserves explanation. Some commentators have cited the moral dilemmas of the Indian leaders as obstacles in reaching the strategic decision in time and others point at the lack of technological expertise to achieve the test. However, the following facts indicate the contrary. Firstly, the Canadians, who had come in closest contact with the Indian nuclear scientific community in the process of setting up the first reactor, pressed the international community the hardest for safeguards against India as they were convinced that India was close to making an explosive device.[31] Secondly, for a short period of time the Americans were toying with the idea of assisting India in achieving an atomic explosion to neutralize political advantage gained by the communist block after USSR aided Chinese explosion.[32] In this context Bhabha had offered, in 1965, that 'with

a US blue print it (India) could do the job in six months.'[33] Finally, Lal Bahadur Shastri, the then Indian Prime Minister, had already authorized the Indian Atomic Energy Commission (AEC) to prepare for a nuclear test,[34] despite strong opposition from within and outside the government. This shows that the 1962 defeat and the 1964 Chinese nuclear test had already edged the Indian leadership to overcome their earlier Nehruvian moral dilemmas. In fact during the period 1964 to 1974 it was 'the heightened interplay and tension between external and internal compulsions in Indian nuclear decision making'[35] that drove the incremental progress of the nuclear program with the 'option strategy' as the political guiding principle.

The background will be incomplete without mentioning the US nuclear coercion of India in the 1971 Indo-Pakistan war. 'Perceiving a threat to an ally (Pakistan), the United States responded by moving a large naval force into the Bay of Bengal off the coast of India.'[36] The threat of use of force was obvious but 'since the fleet was equipped with nuclear weapons, and since it had little effective conventional capability to prevent an Indian invasion (of Pakistan)'[37] an implicit nuclear threat also existed. It has since been revealed that the mission of the carrier group was to neutralize a probable Soviet pressure on China to prevent it from intervening in the war against India.[38] In the same context President Nixon had disclosed subsequently that 'he did contemplate the use nuclear weapons at that stage.'[39] India firstly, did not like being made a pawn in the superpower politics in the region and secondly, viewed this incident in the light of other nuclear coercion incidents wherein the common key characteristic had been asymmetry of nuclear weapons capability.[40] Added to the incident was the fact that India itself was a conduit for many U S nuclear threats to China in 1950s, which surprisingly stopped after

1964.[41] By 1971 the United States was secretly courting China because 'a nation of 800 million, armed with nuclear weapons, could not be ignored.'[42] 'The experience of nuclear intimidation' and the associated developments 'must have influenced Mrs. Gandhi in giving the green signal for the nuclear test.'[43]

Pokhran-I to Pokhran-II

On 18 May 1974 at 08:05 AM India tested its 'peaceful nuclear explosive' (PNE). Some observers claim this to be the beginning of the Indian nuclear weapon program and argue that the atomic device was termed PNE mainly because of '(the) commitment that the Canada–India reactor would not be used for purposes other than peaceful.'[44] In the period preceding the test even the United States, suspecting a weapons program, exerted pressure on India to refrain from testing despite the fact that the nuclear powers were negotiating a 'threshold test ban treaty, which would permit each country to use peaceful nuclear explosives of less than 150 KT.'[45] The argument was that a distinction could not be made between a PNE and a weapon. India however, asserted her right to pursue peaceful nuclear applications including a PNE.[46] Irrespective of the legalities of the terminology India did not embark upon a weapons program as yet. The Indian Prime Minister declared that 'we have discussed the question deeply and rejected the idea of making the bomb' because 'once we launch into making it we would have to incur heavy expenses to keep abreast of nuclear weaponry.'[47] In addition, 'she genuinely felt horrified by the bomb' and 'upon reflection her doubts about the morality and worth of nuclear weapons intensified.'[48] The PNE program was thus actually what it claimed to be and too unlike a weapon program. Irrespective, there was international denouncement of India for undermining the non-proliferation efforts. However, the superpowers were

themselves on shaky ground to take any concerted and concrete action against India. India had stated that it 'would not sign a non-proliferation treaty unless the nuclear weapon states took significant steps toward disarmament' and at the time of the tests 'agreements reached by the United States, the Soviet Union, and Great Britain could not by any standards be described as disarmament measures.'[49]

A question often asked is that if the Pokhran-I was a PNE why did India not continue with more such tests? After Pokhran-I 'the scientists had assumed that other tests would follow' but 'moral doubts, competing domestic priorities, and international considerations combined to turn India's prime ministers away from a nuclear weapon programme.'[50] The domestic priorities ranged from issues of socio-economic development and 'increasing anti-bomb, pro-NPT, and pro-CTBT coalition … with a strong voice in the Ministry of External Affairs and Prime Minster's Office'[51] to immediate political considerations. The international considerations were mainly the backlash to the first PNE and fear of Western economic and political pressures.[52]

During the period 1975 to 1995, while the factors mentioned earlier prevented India in closing its nuclear option in favor of the weapons, the changing political and nuclear equations in the region and around the world also prevented India from closing the option in favor of abstinence. 'In 1978 the US government flirted with the idea of giving India the satisfaction of seeing its disarmament proposals adopted by the superpowers.'[53] However, Carter, the then US President, decided to follow the advice of his defense secretary who argued that 'a ban on fissionable material would not be in the interest of the United States because the United States no longer had a commanding lead in developing and producing nuclear warheads.'[54] Through the early 1980s the US

administration continued to push through military assistance to Pakistan 'even though it was known that Mohammed Zia ul Haq, the country's dictator, was assembling the equipment and materials to build atomic bombs' because 'the United States depended on Pakistan to channel weapons and funds to anti-Soviet' resistance in Afghanistan.[55] The Reagan government's reasoning though that this would give Washington some leverage 'to get Zia to hold off on going nuclear'[56] was in consonance with the US non-proliferation policy of the day.

'The Indian nuclear weapons capability drive was not fuelled by … (that of) Pakistan' instead India insisted on retaining its nuclear option 'primarily to counter what it perceiv(ed) to be the intimidating nuclear might of China.'[57] Most analysts underestimate the China factor in assessing the security situation in South Asia and instead tend to reduce the issue to India-Pakistan rivalry. This is despite the fact that 'China indeed believes that India will remain one of its most likely foes over the next couple of decades'[58] and as cynics say, 'China is determined to fight India to the last Pakistani.'[59] The China factor assumes added importance in view of 'close Sino-Pakistani strategic ties since 1950s and by increasing international evidence of Chinese nuclear and missile technology assistance to Islamabad,'[60]despite China being an NPT signatory. Chinese support to Pakistani (and other) nuclear and missile programs, in contravention to all non-proliferation pledges that China is a party to, have led to imposition of two US sanctions in 1991 and 1993.[61] Desmond Ball, quoting the Far East Economic Review, writes the following on the Sino-Pakistani strategic collusion:

> In 1974 … China reportedly assigned twelve scientists 'to help Pakistan develop a nuclear device'; in 1977, China agreed to assist Pakistan with the construction and testing of a nuclear weapon; in 1983, China gave Pakistan a 'complete design for a nuclear weapon and enough enriched

> uranium for two bombs'; in 1986, China gave Pakistan enough tritium gas, as well as enriched uranium, for ten nuclear weapons; in 1989, Pakistani scientists were allowed to observe a Chinese nuclear test; and during the 1990s China has provided Pakistan with the technology to manufacture critical technologies, including a 300-megawatt reactor, a tritium gas purification plant, and ring magnets for production of weapons-grade uranium.[62]

India may have learned to live with China as a nuclear power as it indeed had done for the past three decades though with implicit security assurance from the USSR. However, the continuous Chinese arming of Pakistan with nuclear weapons and missiles created a condition of two closely aligned hostile nuclear powers on India's borders, both of who had claims to vast Indian territories, and made India have a fresh look at its strategic environment. Despite the provocative situation, India did not embark upon a weapon program and was content with the security in the ambiguity of the threshold status. In as late as 1988 McGeorge Bundy wrote that 'India had a successful test in 1974 but India in 1988 still has the option not to "have the bomb." There is no Indian program comparable to the one that has become evident in Israel, and indeed no Indian leader has yet found it imperative to move from a test to a clear commitment to weaponry.'[63]

The Sino-Indian competition is explained in terms of China's policy to 'prevent the rise of a peer competitor' to challenge its status as Asia Pacific's dominant power.[64] With Pakistan already an ally, China started its encirclement of India with its military forays into Myanmar (Burma) since 1990. In addition to providing military aid of US $ 2 billion, China established electronic listening posts and military facilities on Myanmar's Coco islands opposite, and within striking distance of, India's Andaman and Nicobar islands and missile testing site in the Bay of Bengal.[65] In the North, China improved its troop presence from 100,000 to 400,000. In addition, runways were extended to handle China's newly acquired long range Su 27 fighter aircraft.[66] 'Moreover, from 1995

onwards the Clinton administration not only chose effectively to condone the Sino-Pakistani nuclear and missile cooperation,' despite intelligence confirmation of the transfers, but 'actually stepped in to approve the first export of satellite and advanced nuclear technology to China.'[67] It was disturbing for India to note trade and commerce considerations overtaking US non-proliferation concerns. Charles Krauthammer said, 'There is nothing quite like US-China strategic partnership to put the fear of God in India.'[68] Especially so in the absence of a strong Russia which had earlier provided the semblance of a security umbrella to India; the security clause of Indo-Soviet friendship treaty having been scrapped during its re-negotiation in 1992. In 1971, the development of détente between the Unites States and China, resulting in the declaration of US inability to help India in case of Chinese intervention in the Indo-Pakistani war, formed the precipitous cause for India signing the Treaty of Peace, Friendship, and Cooperation with the (then) USSR. In a similar manner, the emerging Sino-US strategic partnership, at the cost of the nonproliferation and NPT non-adherence concerns, may have helped in pushing India closer to exercising her nuclear option.[69] In a similar context McGeorge Bundy had correctly assessed that 'The Indian position is clearly affected by what other countries do or refrain from doing … In such a situation the choices of the United States and the Soviet Union are also highly relevant, and both will usually be well advised to give a higher rank to nonproliferation than officials with immediate political concerns may prefer.'[70]

The most significant event of the 1990s has been the US victory of the Cold War and breakup of the erstwhile USSR. In the absence of an immediate and obvious threat to the Western powers, India expected tangible progress toward global disarmament. The

nuclear instrument however, 'remains the central element in the defense of the vital interests of the nuclear Powers.'[71] In the United States and Russia, though the format of the nuclear arsenal is envisaged to reduce to 3,500 strategic warheads by 2002-2003, the strategy is to maintain a modern, viable, and diversified strategic arsenal.[72] Similarly, in the case of France though there is a reduction in the volume of the arsenal 'a very significant improvement in quality is also to be seen.'[73] China has categorically refused to consider disarmament till the other NWS reduced their weapon holdings to its own level. The Indian moralistic stance, Indian moral lecturing as Nixon had once termed it,[74] of demanding global disarmament for giving up its own nuclear option had always been an irritant in the Western eyes. 'For the international community, particularly the five nuclear weapon states, India represented a nettlesome, frequently hypocritical and frustrating gadfly.'[75] The year 1995 saw the indefinite extension of the Non-Proliferation Treaty (NPT) which 'divided the world *permanently* (emphasis added) into nuclear haves and have-nots and demonstrated that the five NWS were unwilling to negotiate nuclear disarmament in good faith.'[76]

Maintaining the threshold status still had widespread support inside and outside the government in India.[77] The CTBT (Comprehensive Test Ban treaty) negotiations in 1996 came to be the critical juncture where India was forced to reconsider her 'option strategy'. In order to safeguard her nuclear option India refused to sign the CTBT. India's refusal to sign the treaty in its present form, despite being the first to sign the Partial Test Ban Treaty (PTBT) in 1963 and having cosponsored the CTBT with the United States in 1993 and 1994,[78] originated from mainly three reasons. Firstly, the fact that the treaty would permanently freeze the strategic advantages of NWS with respect to

the Non Nuclear Weapon States (NNWS). In this respect the treaty also did not represent a step towards disarmament as it promised to be at the time of its proposal. India's ambassador to the Geneva talks argued that the extension of the NPT had 'sought to legitimise indefinite possession of nuclear weapons by five countries' and the CTBT was now seeking to legitimize 'the right to continue development and refinement of their arsenals.'[79] Secondly, on signing the treaty the Indian nuclear option would be closed at a less credible deterrence level because of non-testing for twenty-two years. For this reason, and in view of the fact that NPT had recently been permanently extended, the treaty came under scathing attacks in the domestic political circles, with unanimity of opinion in favor of safeguarding the nuclear option.[80] A debate ensued on whether it was necessary to test to assure the credibility of the deterrence and was concluded in favor of the test.[81] Finally, India saw the controversial 'entry-into-force' clause in the final form of the treaty, which made the treaty's implementation contingent upon ratification by India, Pakistan, and Israel, a maneuver specifically aimed at India since the other two threshold states had NWS patrons. The clause was inserted mainly on the insistence of China, supported by Britain and Russia.[82] American officials believed that India would not choose to be isolated internationally and would sign the treaty.[83] This further strengthened the Indian suspicion that the clause was targeted at her and India feared that it would be used by the NWS to impose sanctions against her.[84] India was in effect pushed into a corner and the overall situation presented to her was that if immediate measures to breakout of continuously tightening noose around her 'option strategy' were not taken, very soon there would be no option left.[85]

During the period 1996 to 1998 India underwent some political instability, arising out of coalition politics dynamics inherent in the multi-party parliamentary democracy, such that no tough political decisions could be taken. In March 1998 a stable government was formed and on May 11, 1998, at 03:45 PM India simultaneously detonated three nuclear devices. On May 13, 1998, at 12:21 PM India conducted two more sub-kiloton nuclear tests.

Conclusion

Two conclusions emerge from the foregoing narrative. Firstly, the decision of Indian 'nuclearization' was not arrived at based on uni-dimensional factors. While a couple of events may have precipitated the final act, the process has been that of deliberate debate and consideration over a long period of twenty-four years. Secondly, India was content with the ambiguous nature of its nuclear weapon status since it offered her adequate security without putting demands on her economy to deploy a visible nuclear force. Despite her restraint, the imperatives of superpower politics in South Asia, her deteriorating security environment, a nuclear armed China across the border with unresolved territorial issues and providing nuclear support to Pakistan, lack of assurance of global nuclear disarmament in the foreseeable future, and renewed boost to the non-proliferation regimes that pushed India into a situation of 'use it or lose it' dilemma about her nuclear option finally forced her into overt 'nuclearization'. Both these factors will be of influence on the emerging Indian nuclear deterrence posture that I will discuss in the next chapter.

Notes

[1] David Albright, "The Shots Heard `Round the World," *Bulletin of the Atomic Scientists*, Vol. 54, No.4 (July/August 1998), n p, on-line, Internet, available from http://www.bullatomsci.org/issues/1998/ja98albright.html.

[2] Barry B. Hughes, *Continuity and Change in World Politics: Competing Perspectives*, 3rd ed. (Upper Saddle River, N.J.: Prentice Hall, Inc., 1991), 47. See for detailed discussion on the theory of 'Realism' and definition of 'Security Dilemma'.

[3] Bradley Thayer, "The Causes of Nuclear Proliferation and the Utility of Nuclear Nonproliferation Regime," quoted in George Perkovich, *India's nuclear Bomb: The Impact On global Porliferation* (Berkley and Los Angeles, C.A.: University of California Press, 1999), 5.

[4] William E. Burrows and Robert Windrem, "Critical Mass: The Dangerous Race for Super Weapons in a Fragmented World," quoted in Haider K. Nizamani, *Roots of Rhetoric: Politics of Nuclear Weapons in India and Pakistan* (Westport, C.T.: Praeger Publishers, 2000), 5.

[5] Haider K. Nizamani, *Roots of Rhetorici,* 7. See for the definition of the term 'Orientalist'.

[6] Ibid., 7.

[7] Albright, 1. This stereotypical label of the political party (BJP) in power at the time of the nuclear tests is found in most American reporting. This fallacy most probably pertains to the facts that the party's parental organization (RSS) has predominant Hindu membership, in 1947 it opposed the idea of Indian partition on religious grounds, and till late after the Indian partition expressed views indicating that they had not accepted the creation of a Muslim Pakistan. Perhaps Jana Sangh, BJP's precursor party, may fit the image, which the label intends to depict, more closely.

[8] Margaret Gowing, "Independence and Deterrence: Britain and Atomic Power," quoted in William Sweet, *The Nuclear Age: Atomic Energy, Proliferation, and the Arms Race*, 2nd ed.(Washington, D.C.: Congressional Quarterly, 1988), 120.

[9] Ibid., 120.

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[18] Ganguly, 40.

[19] Perkovich, 14.

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[23] Sweet, 132.

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[25] Ganguly, 41.

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[42] Subrahmanyam, 12. Statement of the US President's Press Secretary explaining the 1971 secret visit of Dr Henry Kissinger to China.

[43] Ibid., 31.

[44] Subrahmanyam, 30.

[45] Sweet, 139.

[46] Perkovich, 159.

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[48] Ibid., 188.

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[53] Sweet, 148. See also Kapur, page 123, for the details of the Indian disarmament proposal.

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[72] Ibid., 101.

[73] Ibid., 101.

[74] In context of Nehru's calls for global disarmament and peace, while at home initiating police action in the Portuguese colony of Goa to secure its accession to India.

[75] Perkovich, 464.

[76] Malik, 9.

[77] Deepa M. Ollapally, "India's Strategic Doctrine and Practice: The Impact of Nuclear Testing", in *India's Nuclear Security,* ed. Raju G.C. Thomas and Amit Gupta, 74.

[78] Ollapally, 76.

[79] Perkovich, 379.

[80] Ollapally, 76.

[81]GOI, *Evolution of India's Nuclear Policy*, 4.

[82] Perkovich, 379 and Malik, 9.

[83] Perkovich, 566. Perkovich has quoted this US assessment based on interviews with the US National Security Adviser Anthony Lake.

[84] Ibid., 379.

[85] Air Cmde Jasjit Singh, 9.

Chapter 2

Imperatives of the Indian Minimum Nuclear Deterrence

Introduction

The intent in this chapter is to define and discuss the emerging Indian nuclear deterrence posture. The nuclear posture of a country depends upon a variety of factors the most important of which are technological and economic capabilities, and the strategic environment. However, 'political and bureaucratic factors … usually determine the precise types of forces planned and procured'[1] by the country. In this chapter, considering the draft Indian nuclear doctrine as the political guidance, the 'broad principles'[2] have been first discussed in the light of the deterrence theory. Subsequently, an estimate of number and types of nuclear weapons and delivery systems, that India would need to achieve the desired posture, has been made.

The most important aspect of the 1998 tests is that the nuclear weaponization decision is irreversible. Three characteristics of the Indian nuclear program and the system of governance demonstrate this. Firstly, the oft reiterated Indian refusal of unilateral disarmament. This stand even forced India to veto the CTBT despite India being the original state party to the proposal of the treaty. Secondly, 'from 1964 onwards the … factors … politics, strategy, cost, national identity - were thoroughly aired in public and within the government.'[3] However, in the later years the structure of the

Indian public debate has been to propel the 'identity' argument forward as the key issue.[4] In addition, 'most citizens … appear to think that nuclear weapons would never be used.'[5] This has led to a shift of public opinion from strongly opposing to cautiously favoring the nuclear program, especially in the face of a nuclear threat from Pakistan and China.[6] Finally, the fact that in a democracy it may be comparatively more difficult for a government to roll back the nuclear program than in a more authoritarian form of governance.[7] Strong support to the nuclear program may not earn many votes but any attempt at roll back will surely be used by the opposition as a political agenda. This has been demonstrated by the unwillingness of various Indian leaders with strong anti-bomb opinion, e.g. Moraji Desai and Inder Gujral, to contemplate rolling back the program. Even the present government explained the decision to test as a sequel to the earlier Indian decisions of not signing the Non-Proliferation Treaty (NPT) in 1968, first test in 1974, and not signing the Comprehensive Test Ban Treaty (CTBT) in 1996.[8] These decisions were taken by governments of the Indian National Congress party, which in 1998 was the main opposition party.

In this situation of irreversibility of the nuclear decision it is imperative that right choices are made at this nascent stage of the weapons program. The decisions made and options chosen at this stage will have a lasting impact on the direction this program takes, especially in view of the fact that India has no previous models to emulate in this respect. The USA-USSR model of the Cold War era is inadvisable due to economic cost and the unstable nature of the deterrence followed by these two countries. The models of Britain and France, despite the minimal nature of their deterrence posture, cannot be viewed separately from NATO's overall posture and the ingrained politics. The Chinese model is

said to be based on a truly minimal doctrine of retaining the ability to launch at least one or two missiles at the aggressor[9] and its reliance on nuclear weapons is more as a political than war fighting tool.[10] In this respect, the Chinese model may seem to be the more attractive one to follow. However, the fact that substantially different political conditions exist in China and India, make it impractical for India to be able to follow the model. Secondly, any attempt by India to follow closely in the Chinese path or to match them may be strategically destabilizing with respect to an arms race. The discussion here is not to suggest that the lessons learned during the practice of deterrence theory in the Cold War era be abandoned, especially in view of the fact that the controlled British, French, and Chinese choices in nuclear weapons acquisition demonstrates a steep learning curve.[11] Instead the suggestion is that India must avoid the pitfalls of the 'maxi-minimalist' posture and define her deterrence posture independently with arms race stability as a major goal.

Draft Nuclear Doctrine

Consequent to the nuclear tests, the Government of India constituted the National Security Advisory Board (NSAB) with a task to formalize the doctrinal principles of the nuclear program. The Board issued its Draft Report on Indian Nuclear Doctrine on Aug 17, 1999. A copy of the eight-part report is placed at Appendix A. The doctrine's main tenets are as follows:

a) Minimum nuclear deterrence and retaliation only policy.
b) Absence of country or threat specificity.
c) Ability to cause unacceptable damage.
d) Credibility and survivability.

The concept of nuclear deterrence has been debated, developed, and refined for close to sixty years now. Despite that fact 'our modern idea has little changed from that expressed in the Latin word 'deterrere': to prevent an action by someone because of his fear of the consequences.'[12] What differs is the use of the concept of deterrence, which is universal, to formulate policies and postures, that are specific to a country or political system. Two peculiarities of the deterrence debates in context of the superpowers have been that the 'main deterrence theory perceives the world in a bipolar way' and the 'concept of total deterrence.'[13] Deterrence is an inherently stable concept. The fact that its practice during the Cold War led to the production and deployment of 55,000 to 60,000 weapons a piece by the two main protagonists has always been a cause of concern for the employment of this concept in relation to any two rivaling countries. The most important factor that propelled the 'maximalist' US-USSR posture was that the deterrence debate during the Cold War overtook the deterrence theory itself. If the function of deterrence is to deter, and not to compel use, than the introduction of the hypothesis of a nuclear war, with flexible response and tactical weapons based upon the idea of escalation control or dominance, undermined the basic premise. Technological advances gave birth to the idea that a nuclear war can be fought without catastrophe and with only damage. It was for this reason that the stability inherent in deterrence was overcome and an unstable condition was created.

It, however, needs to be recognized, as argued by Kenneth Waltz,[14] that deterrence can exist at levels lower than maximum. China, UK, and France, before the linkage to North Atlantic Treaty Organization (NATO) extended the maximum deterrence to the latter two, had constructed their nuclear posture on the *minimum deterrence* levels.[15] The

term itself originated during the Cold War and can be defined as the 'lowest level of weapons that can cause death and destruction, which if imposed on the adversary, would deter it.'[16] Since the end of the Cold War this term is also used to define the emerging nuclear posture of the five NWS, particularly the United States and Russia. The fact is that this deterrence level still permits 3000-3500 deployed strategic nuclear weapons and 2500 to 3500 tactical weapons in the case of the United States and Russia, and 250 to 650 in the case of other NWS.[17] In this respect two factors need to be considered. Firstly, 'the size and configuration of the minimal deterrent force is a function of … military-political setting in which it would be implemented.'[18] This, in turn, affects how a country defines the word minimum. For instance, in the case of France 'minimum deterrence' has always been equated with 'strict sufficiency,' which means a posture of always having sufficient resources to inflict upon the adversary losses more than the gains his aggression could bring him.[19] Secondly, the quantitative level of minimum deterrence is a function of certain qualitative factors too. These are targeting, implementation strategy, redundancy, survivability, the relation to conventional capabilities of opponents, defensive systems, and the relation to third country nuclear weapons.[20] Ten Indian nuclear weapons ready and targeted at ten Chinese cities, despite unavailability of a ballistic missile that can reach Beijing, and twenty-five untargeted weapons at a lower state of readiness even with a missile capable of reaching Beijing represent two different levels within the minimal deterrence concept. The draft doctrine's minimum deterrence level must be seen in relation to these two factors. In this respect the stated policy of 'retaliation only' in the draft doctrine assumes added significance. This policy defines the nuclear weapons purely as a nuclear deterrence mechanism rather than war fighting

tools. The 'retaliation policy' also precludes, at the outset, the 'early-nuclear-use' doctrine and thus requirement of a hair trigger alert system, 'launch-on-warning' strategy, or weapons ever ready on missiles and aircraft and aimed at specific targets. The Indian deterrence posture does not seek to mimic the Cold War, or even post Cold War, 'maxi-minimalist' postures of the NWS. The draft doctrine, instead, seeks deterrence through highly survivable 'second strike' capability for retaliatory use only.

It would seem that the 'minimum' is the lowest level for the deterrence to exist. However, if the concept of bi-polarity is removed, a survivable and credible nuclear arsenal can exist which is not country specific and does not depend upon any assertions but on the uncertainty of its existence and use - the existential deterrence.[21] The draft doctrine, by avoiding to make it country specific and uncertain, indicates at such a deterrence. While some statements emanating from the Indian leadership, specifically from Defense Minister Georgr Fernandes,[22] after the nuclear tests aimed the deterrence at China, the non-specificity of country and threat in the draft doctrine is explained in terms of the Indian perception of the present political situation. While Indian strategic thinkers do not deny the existence of a uni-polar world order, in the Indian perception this political situation is temporary. They perceive the political scenario still in transit.[23] In addition, the uni-polarity has been argued to cause instability, and consequently uncertain security environment, in the lack of a balancing power.[24] In essence the political and strategic environment is seen as fluid and uncertain. The doctrine's avoidance of a specific country as a threat is akin to what the French have defined as 'the posture of strategic vigilance characterized by the absence of a specific enemy but also (characterized) by a … nuclear force whose … credibility remains intact.'[25] As Bruce

Larkin noted, 'deterrence is not achieved by large numbers, but by the credible capability to strike at all.'[26] In such a perception of the strategic environment where 'there is no designated enemy and the political landscape is fluid, the weapons need not – and should not – be targeted in peacetime.'[27] This though will increase the demands of flexible targeting options for the weapons.

The next issue is the concept of unacceptable damage. It has been argued that while 'think tank analysts can set levels of acceptable damage well up in tens of millions of lives … in the real world of real political thinkers … even one hydrogen bomb on one city of one's own country would be recognized in advance as a catastrophic blunder.'[28] In a nuclear exchange the question is not win or lose but the uncertainty between survival or being annihilated. As Kenneth Waltz argues, 'Do we expect to lose one city or two, two cities or ten? When these are the pertinent questions, we stop thinking about running risks and start worrying about how to avoid them.'[29] In absolute terms the Waltzian argument is acceptable but in relative terms the unacceptable damage requires further clarification. Bernard Brodie also argued that even the ambiguity of a single thermonuclear weapon from a small state reaching Moscow would give the Soviet government much pause. However, he further went on to argue that the Soviets 'would not invoke the destruction of Moscow wantonly, that is, for *trivial gains*' (emphasis added).[30] Which is to say that it was perceived that they may wager the destruction of Moscow (or another city) for a certain '*higher gain'*. In relative terms, this seems to be a plausible argument. The sensitivity of governments to the suffering of its citizens and loss of their life varies depending upon numerous factors. This is borne by the fact that there exist governments/regimes, which find 'gassing' their own citizens, or genocide, a

legitimate use of political authority, and thus a given amount of damage may not cross the unacceptability threshold of all the countries. In addition, the assessment of unacceptability of damage is also affected by one's perception of the enemy. Robert McNamara's assertion that destruction of a fourth of Soviet population and a half of its industrial capacity was the minimum required to deter it is well known,[31] whereas Geoffrey Kemp concluded that 10 % to 15 % of urban population and up to 25 % industrial capacity may be sufficient.[32] No empirical formula can thus be devised. The only criterion to keep in mind is that the damage threatened should be *unacceptable to the adversary* and not what one thinks would be *unacceptable to oneself*.

This leads us to the issue of deterrence credibility. Kenneth Waltz poses the question 'Will an adversary believe that retaliation threatened will be carried out?'[33] The answer to the question depends upon two issues. The first issue is the ability to produce, maintain, deploy, and protect the deterrent forces. In the post-Pokhran scenario there have been suggestions that having demonstrated the ability to produce, India does not need to fully weaponize, not at least till threat perception demands it.[34] This is a specious argument and such a recourse will directly undermine the credibility of the deterrence. As argued by Waltz, deterrence with low credibility will raise the chances of preemption as the adversary will be led to conclude that a first strike may actually have chances of complete success.[35] This in turn will defeat the basic deterrence mechanism. The draft doctrine itself though is clear on the issue and seeks to deploy a credible deterrent force. In addition, it must be emphasized that the credibility of the deterrence is high only when all the components of the deterrent force are indigenous. Forces deployed with borrowed and leased components are inherently less credible since in a fluid international political

environment no ally can guarantee unconditional and permanent support. In this respect the example of Britain is worth emulating, which insisted upon creation of independent deterrence despite special friendly relations with the United States, of the order that India does neither presently have with any country nor can reasonably hope to have in the near future.[36] Indigenous forces also afford the flexibility of deployment of the nature that the draft doctrine seeks in defining the Indian deterrence as a 'dynamic concept, related to the strategic environment, technological imperatives and the needs of national security.'[37] India will thus be well advised not only to fully weaponize but also to continue to develop and refine the design and capability of its nuclear weapons and delivery systems so as to reach total self-sufficiency. The second issue, of demonstration of the will to employ, is more psychological. The answer hinges on the fundamental logic of the existential deterrence. Given the uncertainty of numbers, capabilities, the survivability of adversary's arsenal, and his will to launch, it is impossible to make an estimate of assured success in a nuclear attack. Thus, the would be 'attacker is deterred even if he believes only that the attacked *may* retaliate.'[38]

The requirements of credibility and stability of deterrence appear to contradict each other. Too credible a deterrence may induce a security dilemma and destabilize the deterrence. However, one basic tenet of deterrence theory, especially the concept of existential deterrence, is its unilateral nature in the sense that own force structure is, to an extent, immune to that of the adversary. If a certain number of weapons will deter an enemy then they will continue to do so irrespective of the enemy's force level till, of course, the enemy force level becomes so high and advanced as to give him an assurance of complete success of the first strike. An advanced Chinese nuclear weapon program

does not take away the deterrent capability of a less advanced Indian program. Thus, the inherent stability is not likely to be affected by the credibility aspect if the qualitative factors, mentioned earlier, are balanced properly.

The next issue is that of survivability. This is the most important issue especially in view of the 'retaliation only' policy and second strike capability. The draft doctrine specifies that the nuclear forces 'will be based on a triad of aircraft, mobile land based missiles and sea based assets.'[39] This assertion once again tends to contradict the purely minimal posture. However, in light of the preceding discussion, the triadic forces are aimed at diversification of the forces to ensure survival of the deterrence than escalation of the posture. The type of delivery system that a country may choose to employ will depend upon the economic and technological means available and the strategy for employment of these systems. In the Indian strategy of retaliatory use after surviving the first strike by the aggressor the delivery system assumes great importance.

It has been argued that 'if it were possible to guarantee the survival of a hard-core retaliatory force of reasonable size by protecting massively in individual shelters' then this would surely have been the most preferred option.[40] However, land-based static systems are most vulnerable to attack and even with extensive hardening do not give fail-proof guarantee of 'being strong enough to withstand the attack' if singled out for it.[41] Static missile locations are also less amenable to camouflage and concealment from enemy intelligence and reconnaissance efforts. The land-based mobile missile system, spread over the vast Indian land mass, offers the advantage of the enemy never being able to assess the exact location of all the missiles at a given time. Added to it is the advantage that the system may change its location by tens of miles even after an enemy

launch, depending upon the type of transportation system utilized. Considering the extensive rail network in India a rail-mobile system will be a viable option. A tracked Transporter Erector Launcher (TEL) vehicle on the other hand will provide cross-country ability. The present Indian satellite launch vehicle is said to be too heavy to be utilized effectively as land-mobile ballistic missile system. The rail-mobile system may help in overcoming the problem at least in the short term till the weight is reduced. The land-mobile system is amenable to considerable deception and concealment also, which adds to its survivability. The long-range ballistic missiles also have a much greater chance, compared to gravity-dropped bombs from aircraft, of penetrating the enemy defenses. In addition, the present Indian missile program is at a stage to produce such a system in the very near future.[42]

Manned aircraft bombers have similar problems as missile silos of protection while on the ground. However, considering the numbers and dispersal of airbases in India and the fact that construction of more airbases will be cost effective compared to construction of missile silos as the former can be used for other purposes too, the problem is of lesser magnitude. Keeping the aircraft airborne may solve the problem substantially but, along with the attendant tankers, the option is extremely expensive and in any case the vulnerability of the aircraft to a concerted enemy air action will still remain. In addition, it is not suitable to the non-provocative Indian posture sought by the doctrine. The aircraft though has two specific advantages over missiles. Firstly, the aircraft delivered weapons can be more accurate than those delivered by ICBMs. Secondly, the advantage of 'recallability,'[43] where the aircraft can be launched and kept within its own territory even at an inconclusive warning of attack and can be recalled if the decision was

erroneous. Though the effectiveness of this scheme cannot be denied it does not seem in consonance with the 'retaliation only' policy being advised. It must however be clarified that 'retaliation only' does not mean giving the enemy an assurance that India will not move till she has felt some nuclear bombs over Delhi. Even the draft doctrine refers to the 'capability to shift from peacetime deployment to fully employable forces' linked to the threat level.[44] Within this context, the specialty of the manned aircraft is an attractive attribute. Amongst the present Indian aircraft fleet none are capable of launching long-range bombing missions, say for example deep inside the Chinese territory; this may entail air to air refueling. If long-range strategic bombers are produced, the problem may ease out but these platforms may still suffer a high attrition rate against an effective air defense system, unless, of course, the full complement of AWACS, long range escorts, air to air refueling and electronic warfare is used. Availability of this package, though feasible within the next decade or so, is once again likely to be a costly proposition. An optimum solution may be to use the aircraft to deliver long-range missiles, like a cruise missile. Cruise missiles are also more accurate than some ballistic missiles. This will optimize the advantages of both systems. Considering the progress of the Indian missile program in this direction the availability of such a system is in the future. However, this option, for the advantages of survivability, accuracy, and effectiveness that it offers, must surely be pursued.

Nuclear powered submarines (SSBN) with Submarine Launched Ballistic Missiles (SLBM) also present advantages of survivability. As far as surviving the first strike is concerned the submarines on patrol are the most resistant. Considering a fleet of six submarines, with half of them always on patrol, and fifteen launchers per submarine, at

least forty-five weapons will have the highest chances of survival. In addition, the submarines also have a greater degree of flexibility in deployment between different theaters. Submarines, it is argued, become easy targets for Anti Submarine Warfare (ASW) once they launch their first weapon. This will depend firstly, upon the sophistication of the enemy ASW capabilities and secondly on whether the submarine launches its weapons simultaneously (in quick succession) or in a controlled manner over a period of time. In the latter case, the chances of interception are higher. However, in our concept of deterrence, the use of these weapons is considered a last-ditch maneuver. Thus, the submarines will follow the simultaneous launch strategy and the chances of interception before the full complement of weapons is used will be negligible. In case for some reason a controlled response is required one submarine can launch all weapons at one go and the sequence of launch between submarines can be controlled. Nothing much is known about the Indian nuclear submarine program except that it exists. From the data available in the unclassified realm an indigenous nuclear submarine fleet or an SLBM with substantial range may not be a possibility at least in the near future.

The final issue is of the doctrine's guarantees with respect to stability in the region. Irrespective of the differing points of view on minimum deterrence level everyone agrees that the idea of deterrence is 'to enhance stability, reduce the possibility of war, reduce the consequences of war if it takes place, and reduce the cost of military preparations.'[45] In this respect it is well recognized that nuclear weapons have deterred their use in the past and will continue to do so in the future. In the worlds of Morton Halperin, 'the future of nuclear deterrence is essentially the same as the past, namely … they simply are not credible for use in any situation other than to deter use by others.'[46] The draft

doctrine's assertion of 'no first use' and 'no use against a non-nuclear state' is an extension of the same belief. Since deterrence aims only to deter it is futile to threaten a non-nuclear state as it could not have launched a nuclear weapon in the first place except, of course, in concert with a third, nuclear state. Devin T Hagerty, in his case study Nuclear Deterrence in South Asia, has shown that in a specifically tense situation concerning India and Pakistan in 1990, the existence of opaque nuclear deterrence may have actually deterred even conventional war.[47]

As for stability, three forms – strategic, crisis, and arms race – deserve discussion in the light of the fact that India will, in the near future, produce or procure the envisaged force levels.[48] Strategic stability exists when both sides are assured of a credible second-strike capability, crisis stability exists when neither side fears a preemptive strike and arms race stability exists when neither side perceives the other's actions as undermining strategic or crisis stability. Strategic stability does not exist in the Sino-Indian context, wherein China possesses overwhelming nuclear might against a lack of second-strike capability with India. A stable condition will thus exist only once India acquires the proposed force levels with credible second-strike capability. With respect to Pakistan, strategic stability presently exists wherein 'neither side can be certain that its extant capabilities will enable it to carry out a decapitating first strike.'[49] The guarantee implied in the draft doctrine, that the weapons will be deployed in low readiness states in peacetime with the status raise linked to the threat level, will aid in ensuring this condition even when the proposed force levels have been acquired. This is borne by the recent extension of the Indo-Pakistani treaty forbidding attack on each other's nuclear facilities despite continuing tense situation on the Western Indian border. A similar

solution, of de-mating the weapon from the delivery system, has been suggested for the NWS in the post Cold War scenario as a confidence building measure.[50] Crisis stability is also likely to be enhanced with the Indian acquisition of proposed forces, which will not give India a preemptive capability but will increase the uncertainty of success and thus dissuade a disarming Chinese or Pakistani preemptive attempt.

The question of arms race stability is more vexing because it is dependent upon perceptions. For instance, China and/or Pakistan may perceive Indian acquisition of triadic forces or deployment of long-range ballistic missiles as undermining the existing stable condition. While the underlying premise of existential deterrence argues against this tendency, the qualitative factors influencing deterrence may balance the uncalled for fears arising out of the non-provocative Indian posture, and sociopolitical and economic considerations may prevent an arms race the chances of such a situation emerging cannot be entirely ruled out. The guarantees of 'no first use' and release of weapons at the highest political level may not be taken at their face value in the absence of formal agreements. The only solution to this problem is to start a three way Sino-Indian-Pakistani dialogue about future force levels, acquisitions, and deployment, to institute confidence building measures, and to formalize these guarantees by bilateral or multi-lateral pacts and treaties.

Minimum Deterrence Force Level

The foregoing discussion shows that while India intends to finally deploy a triadic deterrent force, in the near future such an indigenous option may not be available. In addition, a full complement of foreign procured air and sea-based delivery systems will neither be the practical nor the economical option. On the other hand, a variety of

indigenous land-mobile Short Range Ballistic Missiles and Intermediate Range Ballistic Missiles (SRBM and IRBM) are under development and deployment. In this scenario the most viable option, for the near future, is to deploy the nuclear weapons on the land-mobile missiles. For this reason the calculation for the minimum number of weapons and delivery systems, that India may need to deter a major nuclear power with retaliation only posture, has been based only upon the land-based missile system. The calculations are placed at Appendix B.

Conclusion

The discussion in this chapter has probably posed as many new questions as it has attempted to answer. Some of these have been through the assumptions made during the course of the discussion and others with entirely fresh issues, which were out of the scope of this research. What would be the Indian response if the NWS reduced their nuclear weapons to a very low number, say 350 each, but continued to improve their precision and quality? Would this force India to abandon the self-imposed moratorium on testing? Would she test again to improve the quality of her deterrence, choose to have a large stockpile of qualitatively poorer weapons, or remain stable? What is the economic cost of an indigenous triadic deterrent force and would the Indian economy be able to absorb the development and deployment of such a force? These and such other questions form the framework of further study and research on the subject. However, within the scope of this discussion three conclusions emerge. Firstly, the draft Indian nuclear doctrine does not suggest an offensive and 'maxi-minimalist' nuclear deterrence posture. It instead envisages a non-provocative but credible 'existential' posture with forces adequate for a secure, second-strike capability. Secondly, diversifying the nuclear forces on ground, on

sea, and in the air is the best way to achieve maximum survivability. In view of the state of the present Indian weapon, missile and submarine programs a land-based mobile missile system is the most suited, viable, expediently available, and economical option for the near future. However, indigenous options of air-launched cruise missiles and a small fleet of nuclear submarines with SLBMs must also be pursued to complete the triad. Finally, India needs to develop and deploy 165 nuclear weapons of 50 KT yield, 70 weapons of 20 KT yield, 200Agni 2/3 missiles, and 35 Prithvi 2/3 missiles to maintain the deterrence posture sought in the draft nuclear doctrine.

Notes

[1] Geoffrey Kemp, *Nuclear Forces for Medium Powers: Part I: Targets and Weapons Systems* (London: The International Institute for Strategic Studies, 1974), 1.

[2] National Security Advisory Board (NSAB), *Draft Report on Indian Nuclear Doctrine*, August 17, 1999, 6, on line, Internet, available from http://www.indianembassy.org/policy/CTBT/nuclear_doctrine_aug_embassy_17_1999.html, p 2.

[3] Stephen P Cohen, "Why Did India "Go Nuclear"?", in *India's Nuclear Security*, ed. Raju G. C. Thomas and Amit Gupta (Boulder, C.O.: Lynne Rienner, 2000), 30.

[4] Ibid., 31.

[5] George Perkovich, *India's nuclear Bomb: The Impact On global Porliferation* (Berkley and Los Angeles, C.A.: University of California Press, 1999), 462.

[6] Cohen, 31. Cohen has reached this conclusion based upon a long running series of opinion polls in the Indian media.

[7] Perkovich, 459-464. Perkovich has discussed this aspect of democratic governments in detail. In addition, he has also argued how the 'unproliferation' models applicable to South Africa, Brazil, Argentina, the Koreas, and Taiwan do not apply to the Indian case due to type of governance and the public perception of the program.

[8] Government of India (GOI), *Paper Laid on the Table of the House on Evolution of India's Nuclear Policy*, May 27, 1998, 7, on line, Internet, available from http://www.indianembassy.org p 3.

[9] Deepa M. Ollapally, "India's Strategic Doctrine and Practice: The Impact of Nuclear Testing", in *India's Nuclear Security,* ed. Thomas and Gupta, 79.

[10] Air Cmde Jasjit Singh, "A Nuclear Strategy for India", in *Nuclear India*, ed. Air Cmde Jasjit Singh (New Delhi: The Institute for Defence Studies and Analyses, 1998), 306.

[11] Ibid., 79.

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[12] Gp Capt R. A. Mason, "Western Deterrence: Posture and Rationale", in *Nuclear Deterrence: Implications and Policy Options for the 1980s*, ed. Dr Barrie Newman and Dr Malcolm Dando (Kent: Castle House Publications Ltd., 1982), 27.

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[14] Kenneth N. Waltz, *The Spread of Nuclear Weapons: More May Be Better* (London: The International Institute for Strategic Studies, 1981), 13-16.

[15] Air Cmde Jasjit Singh, 303.

[16] Ibid., 310.

[17] Michael Brown, "Recent and Prospective Developments in Nuclear Arsenals", in *Nuclear Deterrence: Problems and Perspectives in the 1990's,* ed. Serge Sur (Geneva: United Nations Institute for Disarmament Research (UNIDIR), 1993), 35.

[18] Sverre Lodgaaard, "Opening Addresses", in *Nuclear Deterrence*, ed. Serge Sur, xiv.

[19] Yves Boyer, "Questioning Minimal Deterrence", in *Nuclear Deterrence*, ed. Serge Sur, 103.

[20] Alexei Arbatov, "Responses", in *Nuclear Deterrence*, ed. Serge Sur, 48.

[21] McGeorge Bundy, "Existential Deterrence and Its Consequences", quoted in Devin T. Hagerty, "Nuclear Deterrence in South Asia: The 1990 Indo-Pakistani Crisis", *International Security*, Vol. 20, No. 3, (Winter 1995/96): 87.

[22] Raju G.C. Thomas, "India's Nuclear and Missile Program", in *India's Nuclear Security*, ed. Thomas and Gupta, 88.

[23] Cohen, 21-24.

[24] K Subrahmanyam, "Clear and Present Danger: US Path to Unipolar Hegemony", quoted in Thomas, "India's Nuclear and Missile Program", 100.

[25] Yves Boyer, 'Responses", in *Nuclear Deterrence*, ed. Serge Sur, 141.

[26] Bruce Larkin, "Nuclear Designs: Great Britain, France, and China in the Global Governance of Nuclear Arms", quoted in Ollapally, 79.

[27] Lodgaard, xiv.

[28] McGeorge Bundy, "To Cap the Volcano", in Kemp, *Nuclear Forces for Medium Powers*, 28.

[29] Waltz, 7.

[30] Bernard Brodie, *The Anatomy of Deterrence* (Santa Monica, C.A.: The RAND Corporation, 1958), 8.

[31] Kenneth N. Waltz, "More May Be Better", in Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate* (New York: W. W. Norton & Company, 1995), 21.

[32] Kemp, 25-31.

[33] Waltz, *The Spread of Nuclear Weapons: More May Be Better*, 17.

[34] Jasjit Singh, 311.

[35] Waltz, *The Spread of Nuclear Weapons: More May Be Better,* 14-17.

[36] Mohan Malik, "Nuclear India: Rationale and Implications", in Desmond Ball and Mohan Malik, *The Nuclear Crisis in Asia: The Indian and Pakistani Nuclear Programmes* (Canberra: Strategic and Defence Studies Centre, 1998), 9.

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[37] NSAB, 2-3.

[38] Waltz, *The Spread of Nuclear Weapons: More May Be Better,* 18.

[39] NSAB, 4.

[40] Brodie, 16.

[41] Ibid., 16.

[42] See Appendix B for details of the present capabilities of the Indian weapon and missile programs.

[43] Brodie, 18.

[44] NSAB, 4.

[45] Michael Brown, "Responses", in *Nuclear Deterrence*, ed. Serge Sur, 60.

[46] Morton H. Halperin, "Responses", in *Nuclear Deterrence*, ed. Serge Sur, 141.

[47] Devin T. Hagerty, *Nuclear Deterrence in South Asia,* 79-114. Hagerty's study was inspired by an account of the same incident by Seymor M. Hersh, in New Yorker of Mar 29, 1993. Hersh, however, arrived at the conclusion that India and Pakistan were on the verge of a nuclear war during the incident.

[48] Sumit Ganguly, "Explaining the Indian Nuclear Tests", in *India's Nuclear Security*, ed. Thomas and Gupta, 57-58. These terms and their definitions used here are as per Ganguly's discussion in his paper.

[49] Ibid., 58.

[50] Halperin, 50.

Appendix A

Draft Report of National Security Advisory Board on Indian Nuclear Doctrine

1. Preamble

1.1. The use of nuclear weapons in particular as well as other weapons of mass destruction constitutes the gravest threat to humanity and to peace and stability in the international system. Unlike the other two categories of weapons of mass destruction, biological and chemical weapons which have been outlawed by international treaties, nuclear weapons remain instruments for national and collective security, the possession of which on a selective basis has been sought to be legitimised through permanent extension of the Nuclear. Non-proliferation Treaty (NPT) in May 1995. Nuclear weapon states have asserted that they will continue to rely on nuclear weapons with some of them adopting policies to use them even in a non-nuclear context. These developments amount to virtual abandonment of nuclear disarmament. This is a serious setback to the struggle of the international community to abolish weapons of mass destruction.

1.2. India's primary objective is to achieve economic, political, social, scientific and technological development within a peaceful and democratic framework. This requires an environment of durable peace and insurance against potential risks to peace and stability. It will be India's endeavour to proceed towards this overall objective in

cooperation with the global democratic trends and to play a constructive role in advancing the international system toward a just, peaceful and equitable order.

1.3. Autonomy of decision making in the developmental process and in strategic matters is an inalienable democratic right of the Indian people. India will strenuously guard this right in a world where nuclear weapons for a select few are sought to be legitimised for an indefinite future, and where there is growing complexity and frequency in the use of force for political purposes.

1.4. India's security is an integral component of its development process. India continuously aims at promoting an ever-expanding area of peace and stability around it so that developmental priorities can be pursued without disruption.

1.5. However, the very existence of offensive doctrine pertaining to the first use of nuclear weapons and the insistence of some nuclear weapons states on the legitimacy of their use even against non-nuclear weapon countries constitute a threat to peace and, stability.

1.6. This document outlines the broad principles for the development, deployment and employment of India's nuclear forces. Details of policy and strategy concerning force structures, deployment and employment of nuclear forces will flow from this framework and will be laid down separately and kept under constant review.

2. Objectives

2.1. In the absence of global nuclear disarmament India's strategic interests require effective, credible nuclear deterrence and adequate retaliatory capability should deterrence fail. This is consistent with the UN Charter, which sanctions the right of self-defence.

2.2. The requirements of deterrence should be carefully weighed in the design of Indian nuclear forces and in the strategy to provide for a level of capability consistent with maximum credibility, survivability, effectiveness, safety and security.

2.3. India shall pursue a doctrine of credible minimum nuclear deterrence. In this policy of "retaliation only", the survivability of our arsenal is critical. This is a dynamic concept related to the strategic environment, technological imperatives and the needs of national security. The actual size components, deployment and employment of nuclear forces will be decided in the light of these factors. India's peacetime posture aims at convincing any potential aggressor that :

(a) any threat of use of nuclear weapons against India shall invoke measures to counter the threat: and

(b) any nuclear attack on India and its forces shall result in punitive retaliation with nuclear weapons to inflict damage unacceptable to the aggressor.

2.4. The fundamental purpose of Indian nuclear weapons is to deter the use and threat of use of nuclear weapons by any State or entity against India and its forces. India will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail.

2.5. India will not resort to the use or threat of use of nuclear weapons against States which do not possess nuclear weapons, or are not aligned with nuclear weapon powers.

2.6. Deterrence requires that India maintain:

(a) Sufficient, survivable and operationally prepared nuclear forces,

(b) a robust command and control system,

(c) effective intelligence and early warning capabilities, and

(d) comprehensive planning and training for operations in line with the

strategy, and

(e) the will to employ nuclear forces and weapons.

2.7. Highly effective conventional military capabilities shall be maintained to raise the threshold of outbreak both of conventional military conflict as well as that of threat or use of nuclear weapons.

3. Nuclear Forces

3.1. India's nuclear forces will be effective, enduring, diverse, flexible, and responsive to the requirements in accordance with the concept of credible minimum deterrence. These forces will be based on a triad of aircraft, mobile land-based missiles and sea-based assets in keeping with the objectives outlined above. Survivability of the forces will be enhanced by a combination of multiple redundant systems, mobility, dispersion and deception.

3.2. The doctrine envisages assured capability to shift from peacetime deployment to fully employable forces in the shortest possible time, and the ability to retaliate effectively even in a case of significant degradation by hostile strikes.

4. Credibility and Survivability

The following principles are central to India's nuclear deterrent.

4.1. **Credibility:** Any adversary must know that India can and will retaliate with sufficient nuclear weapons to inflict destruction and punishment that the aggressor will find unacceptable if nuclear weapons are used against India and its forces.

4.2. **Effectiveness:** The efficacy of India's nuclear deterrent be maximised through synergy among all elements involving reliability, timeliness, accuracy and weight of the attack.

4.3 **Survivability:**

(i) India's nuclear forces and their command and control shall be organised for very high survivability against surprise attacks and for rapid punitive response. They shall be designed and deployed to ensure survival against a first strike and to endure repetitive attrition attempts with adequate retaliatory capabilities for a punishing strike which would be unacceptable to the aggressor.

(ii) Procedures for the continuity of nuclear command and control shall ensure a continuing capability to effectively employ nuclear weapons.

5. Command and Control

5.1. Nuclear weapons shall be tightly controlled and released for use at the highest political level. the authority to release nuclear weapons for use resides in the person of the Prime Minister of India, or the designated successor(s).

5.2. An effective and survivable command and control system with requisite flexibility and responsiveness shall be in place. An integrated operational plan, or a series of sequential plans, predicated on strategic objectives and a targeting policy shall form part of the system.

5.3. For effective employment the unity of command and control of nuclear forces including dual capable delivery systems shall be ensured.

5.4. The survivability of the nuclear arsenal and effective command, control, communications, computing, intelligence and information (C4I2) systems shall be assured.

5.5. The Indian defence forces shall be in a position to, execute operations in an NBC environment with minimal degradation.

5.6. Space based and other assets shall be created to provide early warning, communications, damage/detonation assessment.

6. Security and Safety

6.1. **Security:** Extraordinary precautions shall be taken to ensure that nuclear weapons, their manufacture, transportation and storage are fully guarded against possible theft, loss, sabotage, damage or unauthorised access or use.

6.2. **Safety:** Safety is an absolute requirement and tamper proof procedures and systems shall be instituted to ensure that unauthorised or inadvertent activation/use of nuclear weapons does not take place and risks of accident are avoided.

6.3. **Disaster Control:** India shall develop an appropriate disaster control system capable of handling the unique requirements of potential incidents involving nuclear weapons and materials.

7. Research and Development

7.1. India should step up efforts in research and development to keep up with technological advances in this field.

7.2. While India is committed to maintain the deployment of a deterrent which is both minimum and credible, it will not accept any restraints on building its R&D capability.

8. Disarmament and Arms Control

8.1. Global, verifiable and non-discriminatory nuclear disarmament is a national security objective. India shall continue its efforts to achieve the goal of a nuclear weapon-free world at an early date.

8.2. Since no-first use of nuclear weapons is India's basic commitment, every effort shall be made to persuade other States possessing nuclear weapons to join an international treaty banning first use.

8.3. Having provided unqualified negative security assurances, India shall work for internationally binding unconditional negative security assurances by nuclear weapon states to non-nuclear weapon states.

8.4. Nuclear arms control measures shall be sought as part of national security policy to reduce potential threats and to protect our own capability and its effectiveness.

8.5. In view of the very high destructive potential of nuclear weapons, appropriate nuclear risk reduction and confidence building measures shall be sought, negotiated and instituted.

Appendix B

Estimation of Force Level

1. Introduction

The selection of the topic for this exercise is an indicator of the fact that without specific target selection, target analysis, and accurate intelligence reports on target defenses the results of such a calculation may at best hope to be generalistic. However, considering that population centers and industrial facilities are the main targets, enough data can be collated to permit a broad analysis of the issues.[1] Thus, the intent of this calculation is to reach a representative figure of number and types of weapons, and missiles that India would need to deploy to achieve a *credible, minimum* deterrence with respect to a much larger military, industrial, economic, and nuclear power. It is obvious that such deterrence will be effective with respect to any aggressor, limited only by the reach and sophistication of the delivery system.

2. Weapon Selection

After the 1998 tests a debate has been going on between the Indian and international scientific community on the results of the tests. Indians claim to have tested a fission device of 12 kiloton (KT) yield, a thermonuclear device of 43 KT yield and three more sub kiloton devices of yields between 0.2 to 0.6 KT.[2] The Chairman of the Indian Atomic Energy Commission also claimed that 'India could have produced a 200 KT

thermonuclear weapon.'[3] Some experts disagree with firstly, the yields of the tests and secondly, with the Indian capability to successfully test a thermonuclear device. Fissile material availability with India is, for obvious reasons, shrouded in secrecy and is a matter of speculation. An Oct 2000 Institute for Science and International Security (ISIS) study has suggested that India probably has adequate weapon grade plutonium for the lowest of 45 and the highest of 95 nuclear bombs. In addition there is weapon grade equivalent civil plutonium for 1040 weapons (with an uncertainty factor of 20%).[4] Considering the limitations on available information and the disparity of claims let us consider the worst and the best scenarios. India, at worst, can make a few hundred fission bombs of up to 50 KT yield and, at best, it can make a few thermonuclear devices of 200 KT yield.

3. Delivery System

The delivery system information is comparatively more readily available.[5] India has deployed two versions of surface to surface missile (SSM) called Prithvi 1 and 2 (Earth). These have a range of 150 kilometers (km) with 1000 kilograms (kg) warhead and 250 km with 500 kg warhead. A Prithvi 3 with 350 km range is under development. India has successfully tested its Intermediate Range Ballistic Missiles (IRBMs) Agni 1and 2 (Fire). These have a range of 1500 km and 2500 km respectively with a 1000 kg warhead. An IRBM, named Astra (Weapon), is reportedly on the drawing board. The operational Polar Satellite Launch Vehicle (PSLV) gives India an Intercontinental Ballistic Missile (ICBM) capability of 5000 km to 8000 km and the developmental Geo Stationery Satellite Launch Vehicle (GSLV) gives a demonstrated potential of 14000 km range. The ICBMs will be called Surya (Sun) or Agni 3.

4. Target Selection

An analysis of targets is the most important aspect of weapons requirement with respect to a specific country. The target system analysis helps in achieving the highest possible effectiveness of the weapon by establishing the strength and type of the weapon required, specific aim point, and height of the burst. In the modern industrialized world, the distribution of population presents certain typical characteristics. In most cases it tends to co-exist with, or more precisely, develop around the centers of industry. In addition, most population of a country also tends to be localized in less than ten large economic or administrative complexes. For instance, most of the Chinese population is concentrated in the Eastern one quarter of the country. Eighty percent of total US population lives on twenty percent of the land area and more than thirty-four percent of the population lives in seventeen metropolitans.[6] Three to four percent of the total population of India lives in the three cities of Delhi, Bombay, and Calcutta. Also consider this statement from Geoffrey Kemp, in his 1974 assessment of the Russian population distribution, 'the majority of the population was located in less than a quarter of the country's total area.'[7] This makes the job of target selection a little easier and also helps us define an unacceptable damage criterion for contervalue targets.

If we compare the population of the top ten cities of any industrial country it is apparent that these cities support about seven to ten percent of the total population and fifteen to twenty percent of the urban population. The urban population as a percentage of total population is proportional to industrialization and urban population is more evenly spread over the cities in more industrialized countries, where as it is localized in the top four to five cities in the case of less industrial countries. A comparison of the United States, India, and China is placed at Table-1.

Table 1. Comparison of Population

S. No.	Country	Total Population of Top Ten Cities (Millions)	% of Total Population..
1	USA	22	9
2	India	53	5.3
3	China	61	5.1

Source: The United States Department of Commerce, *Statistical Abstract of the United States: The National Data Book*, 120th edition (Washington, D.C.: US Government Printing Office). *Regional Surveys of the World: The Far East and Australasia 2002*, 33rd edition, ed.Lynn Daniel (London: Europa Publications 2001, 2002)

The major cities are industrial and administrative centers and thus it can be presumed that most of this population is part of the productive industrial, technological, and administrative work force. A credible threat to such large percentage of the productive population and associated industrial infrastructure can be considered to be unacceptable damage. While comparing the population trends the largest dispersion is seen in the population density data. A comparative study of two most populous cities of the United States, India, and China is placed at Table-2 to illustrate the trend.

Table 2. Comparison of Area and Population Density

S. No.	City	Population (Millions)	Area (km^2)	Population Density (persons/km)
1.	New York	7.4	787	9,300
2	Los Angeles	3.5	1202	2,900
3	New Delhi	9.4	1,480	4,200
4	Bombay	9.9	619	16,035
5	Beijing	7.4	-	12,140
6	Shanghai	8.2	-	41,844

Source: The United States Department of Commerce, *Statistical Abstract of the United States: The National Data Book*, 120th edition (Washington, D.C.: US Government Printing Office). *Regional Surveys of the World: The Far East and Australasia 2002*, 33rd edition, ed.Lynn Daniel (London: Europa Publications 2001, 2002)

Notes: i) Figures have been rounded.

ii) The area covered by Shanghai and Beijing Municipal Areas is approximately 6000 $km^2$and 17,000 km^2 respectively. However, since this also includes some rural areas, with much lower population density, and does not conform with the figures considered for the other cities it has not been included in the table.

The population densities vary by large values from one country to another and even within one country. A nuclear weapon of a given yield will thus produce results of varying magnitude. However, the countries with high population are also, normally, the countries with a high population density. Thus, the percentage of the total population threatened will tend to equalize whichever country is considered. The size and spread of a city will also affect the number of weapons required and, most importantly, the point of aim. Most big cities have an area of 600 km^2 to 1500 km^2. However this figure falls rapidly in the case of medium sized cities to about 200 km^2. For this calculation top five cities are considered to be of 1000 km^2 and the next five of 200 km^2. The population distribution is considered to be even and the city shape circular. This may not be the most accurate representation but generally, except for the coastal cities that tend to grow in an elongated manner, land locked cities grow outwards from an imaginary center point. In addition this assumption does not drastically alter the final result.

Any anti ballistic missile (ABM) defenses, and their sophistication, will greatly affect the number of weapons required to be deployed to pose a credible threat to the target. No estimate can be made in advance about such defenses. Considering that the deterrence posture is towards a reasonably developed nuclear power, an ABM system with a Single Shot Kill Probability (SSKP) of 0.8 is presumed.[8] Except in case of a very few countries, the ABM system is not likely to be available for more than one city complex and thus the ABM system availability is considered likely only for the top city

and its surrounding areas. Similar to the above assumption of ABM SSKP a missile launcher reliability of 0.9 and individual missile reliability of 0.9 is assumed. All missiles and warheads will not be available at all times due to the requirements of maintenance or unserviceability. An availability factor of 0.9 is also assumed. Civil defense, availability of emergency handling facilities, and the country's readiness to absorb an attack is another factor that directly affects the extent of damage caused by a nuclear weapon. For instance, it was estimated that in the case of a nuclear attack on a South Asian metropolits 'relatively sparse medical resources available could lead to very high mortality rates among the initial survivors of the attack.'[9] These factors, though, can neither be predicted nor assumed.

5. Weapon Effect

Nuclear weapons affect their target through a combination of thermal, blast, immediate radiation, electromagnetic pulse, and residual radiation effects. These effects not only interact amongst themselves but also are dependent upon such varied factors as height of burst and meteorological conditions. Without going into any greater detail it will suffice to summarize that 'a high airburst will produce most effect against soft skin vehicles and men in the open … so gives the best radius of effects in most cases of military interests. … Ground bursts … are suitable for doing severe damage over a small area or a point target. They will however suck up and distribute considerable amount of radioactive debris causing fallout over very large areas.'[10] 'Whether or not …to use air or surface burst would therefore depend very much upon the purpose of the attack.'[11] For instance, 'if the purpose were to threaten large numbers of *total* casualties over time, then surface bursts would probably be used, since they would maximize local fallout, which

can be very lethal to both human population and food and livestock supplies.'[12] The present accuracy of the Indian missiles is claimed to be between 200 meters (m) to 500 m CEP. With such an error probability it may not presently be possible to aim precisely at any military targets except general targets like cantonment areas. As argued earlier, India would be involved in such a nuclear exchange only as an extreme measure. The immediate aim, in which case, will be to cause maximum immediate harm to stop further attacks and/or punitive retaliation. In this respect it may not be advisable to aim for a large number of deaths over a long period of time. Target type and the meteorological conditions will also affect the type of burst chosen. While the ground burst may be the most suitable for hardened targets, like command and control centers, it may not be the preferred type of attack with the enemy land contiguous to homeland, as the radiation may be carried back home. Especially if the enemy is upwind the radiation may be carried hundreds of miles downwind[13] and may affect even own unprotected civilian population and not only the military personnel, who can be argued to be protected.[14] With this reasoning a low airburst (1000 feet) has been chosen for this calculation.

Since the thermal and radiation effects are highly dependent upon the type of burst, nature of the target, and the meteorological conditions at the time of the explosion, blast effect has been chosen to be the measure of damage for this calculation. This consideration makes the calculation conservative, in the sense that the actual damage caused will be more than that predicted. The blast effect is represented in terms of 'overpressure' expressed in pounds per square inch (psi).[15] Based upon the experimental studies and evaluation of the effects of atomic bomb attacks on Hiroshima and Nagasaki, calculation of fatalities can be made in terms of percentage of people dead with respect to

the overpressure experienced at a certain distance from the 'ground zero'.[16] Experts however also agree on the calculation of fatalities based upon the 'psi ring' method. The method is used here for simplicity of calculations without undue effect on the accuracy of results. According to this method all people with in an imagined circular area having 5 psi overpressure (lethal area) will definitely die and those outside the area with 2 psi overpressure (injury zone) will definitely not.[17] People outside the lethal area but inside the injury zone will survive with injuries. The 5 psi ring also represents the area in which normal city construction buildings (apartment house type) will suffer severe damage.

The area affected by the 5 psi and 2 psi rings are presented at Table 3.[18] A sample calculation is presented below.

- For a 1 kiloton (W^1) weapon exploded at 1000 feet height the distance from ground zero at which 5 psi overpressure exists is D^1 = 2300 feet. = 701.04 m
- For 200 kiloton (W) weapon 5 psi overpressure will exist at $D/D^1=(W/W^1)^{1/3}$
- (Where W^1 is the yield of the standard weapon chosen (1 KT), D^1 is the distance at which the desired overpressure exists for this weapon (701.04 m), W is yield of the weapon for which calculation is being made (200 KT) and D is the unknown distance.)
- Thus $D = D^1 (W)^{1/3}$
- $D = 701.04 (200)^{1/3}$
- $D = 4099.5$ m
- This corresponds to 4088 m (or 4.09 km) horizontal distance from ground zero.
- The area covered by the 5 psi ring = Πr^2, where r = 4.09 km and $\Pi = 3.14$.
- Area = 52.6 km^2.

Table 3. Damage Areas Produced by Different Yields

S.No.	Yield of the Weapon	Area of 5 psi Ring (km^2)	Area of 2 psi Ring (km^2)
1	20 KT	11	39
2	40 KT	19	60
3	50 KT	21	70
4	200 KT	53	176
5	1 MT	155	520

6. Calculation of Weapons Required

If the desired effect at the target is defined as to cover it up with 2 psi overpressure, such that every person in the city will at least be injured where as all people within the 5 psi ring (approximately one third of the 2 psi ring) will die, and all buildings of apartment standard will be damaged whereas industrial structure will suffer moderate to sever damage, then the calculation will proceed as follows:

- Area of the city — 1000 km^2.
- Area of 2 psi ring for a 200 KT weapon — 176 km^2.
- Total number of weapons required — 5.7.
- Weapons required to cater for attrition due to ABM — 5.7/0.2 = 28.5.
- Weapons required for remaining four cities without ABM — 5.7 X 4 = 22.8.
- Weapons required for the five cities of 200 km^2 area — (200/176) 5 = 5.7.
- Total number of weapons required — 28.5+22.8+5.7 = 57.
- Reliability factor of the missile — 0.9.
- Reliability factor of the launch system — 0.9.
- Compound reliability of delivery system — 0.81
- Weapons required catering for reliability — 57/0.81 = 70.4.
- Availability factor — 0.9.
- Weapons required — 70.4/0.9 = 78.2 or 79.

A summary of results of the calculations for all types of weapons considered is placed at Table-4 below.

Table 4. Weapons Required for 2 psi Damage Criterion

S. No.	Yield (KT)	No of Wpns. W/O Reliability Factor	Total Weapons
1	20	259.6	356
2	40	169.7	233
3	50	143	196
4	200	57	79
5	1000	19.02	26

Table-5 summarizes the weapon requirements in case the damage criterion is changed to cover the city with 5 psi. It must be noted that if a 1 megaton (MT) weapon and the matching delivery system are available it will take only 89 weapons to

completely destroy the top ten cities and with a 200 KT weapon the requirement is 259 weapons. In addition, a combination of yields can also be used as a 1 MT weapon against a city of 200 km^2 is an overkill and the city can be destroyed by a much lesser yield device.

Table 5. Weapons Required for 5 psi Damage Criterion

S. No.	Yield (KT)	No of Wpns W/O Reliability Factor	Total Weapons
1	20	909	1247
2	40	526	722
3	50	476	653
4	200	188.9	259
5	1000	64.9	89

The estimate of deaths and injuries arising out of immediate effects of the nuclear weapons in our case tends to be same for any type of weapon chosen because of the peculiarity of this calculation method. In actual case the blast and thermal effects of weapon yields will be different for low and high yield weapons and thus the damage produced will vary. The damage will also depend upon the population density of the target area. A representative value of total deaths caused by 40 KT weapons, considering that the desired number of weapons to cover all the ten cities with 2 psi ring reached their designated targets within the assumed reliability, availability, and ABM effectiveness factors, is presented in Table-6 below.

Table 6. Estimate of Total Deaths Caused by 40 KT Nuclear Weapons

S. No.	Deaths Min Pop Density (2900pers/km^2)	Deaths Max Pop Density (12140pers/km^2)	Deaths Extreme Pop Density (41850pers/km^2)	Deaths Mid Pop Density (9000pers/km^2)
1	5,510,000	23,660,000	79,515,000	17,100,000

The table shows that the total deaths caused will be between one to two percent of the total population of the country. In light of the foregoing theoretical calculations it can be concluded that with a maximum of 235 weapons of 40 KT to 50 KT yield, unacceptable damage can be assured against even a country with fairly sophisticated defenses and sparse population. Let us consider two practical examples to prove the veracity of the calculation. The following example is worked out considering the case of Pakistan and China.

Case A – Pakistan

- 50 kT weapons for five cities with 1000 km^2 area (No ABM defenses) 72
- 20 kT weapons for other five cities with 200 km^2 area 26
- Total weapons 98
- With reliability and availability factor 135
- At least half these cities are accessible to Prithvi 2/3 missiles, all of them in any case would be accessible to the Agni 1/2 missiles. Thus, the delivery system could be Prithvi or Agni depending upon the target.
- Deaths by 20 KT weapons (average population density of 9,000 persons/km) 2,574,000.
- Deaths by 50 kT weapons 13,608,000.
- Total immediate deaths 16,182,000.

Case B – China

The calculation for number of weapons remains the same as above, since no ABM defenses are known to be available. However, the delivery system that can reach the Chinese cities is only Agni 2/3. Thus, 135 Agnis would in any case need to be devoted to the nuclear forces. The population threatened will be higher in number but in about the same proportion to the total population as predicted earlier.

- Deaths by 20 kT weapons (average population density of 12,140 persons/km) 3,472,040.
- Deaths by 50 kT weapons 18,355,680.
- Total deaths 21,827,720.

7. Conclusion

In view of the above two examples, in the present Sino-Indian-Pakistani scenario the theoretical figure of 235 weapons needs to be broken down to 165 weapons of 50 KT, 70 weapons of 20 KT along with 200 Agni 2/3 and 35 Prithvi 2/3 missiles. With this force level unacceptable damage to one country can be projected with 100 weapons of 50 KT and 35 weapons of 20 KT yield. The remaining weapons would still be sufficient to deter the other country with capability to threaten five cities of 200 km^2 area and three cities of 1000 km^2 area. This force level is suggested with the short-term future scenario in mind. It will need to be re-distributed as and when air and submarine delivery capability is made available.

Notes

[1] Geoffrey Kemp, *Nuclear Forces for Medium Powers: Part I: Targets and Weapons Systems* (London: The International Institute for Strategic Studies, 1974), 3.

[2] David Albright, "The Shots Heard `Round the World," *Bulletin of the Atomic Scientists*, Vol. 54, No.4 (July/August 1998), 2, on-line, Internet, available from http://www.bullatomsci.org/issues/1998/ja98albright.html.

[3] Ibid., 2. The seismic results used to assess the yield of May 1998 tests take the data from May 1974 test as the base parameters. The difference of opinion on the yields of the 1974 test, which India claimed to be about 12 KT and the others assessed to be about half to one third that value, continues to the present. Indian scientists point out that since the foreign assessors do not have an accurate model of the region's geology their assessment is flawed.

[4] David Albright, *India's and Pakistan's Fissile Material and Nuclear Weapon Inventories, end of 1999*, (Institute of Science and International Security, 2000), n p, on-line, Internet, available from http://www.isisonline.org/publications/southasia/stocks1000.html

[5] Raju G. C. Thomas, "India's Nuclear and Missile programs: Strategy, Intentions, Capabilities", in *India's Nuclear Security*, ed. Raju G. C. Thomas and Amit Gupta (Boulder, C.O.: Lynne Rienner, 2000), 110-115. Ben Sheppard, "South Asia's Ballistic Missile Ambitions", in *India's Nuclear Security*, ed. Thomas and Gupta, 176-178. Also see the internet site of Indian Space Research Organization http://www.isro.org. All factual information in this paragraph refers to these sources.

[6] The United States Department of Commerce, *Statistical Abstract of the United States: The National Data Book*, 120th edition (Washington, D.C.: US Government

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Printing Office, 2001). *Regional Surveys of the World: The Far East and Australasia 2002*, 33rd edition, ed.Lynn Daniel (London: Europa Publications 2001, 2002). All statistical data pertaining to the United States refers to the Dept. of Commerce document whereas those pertaining to India and China refer to the Regional Surveys of the World.

[7] Kemp, 5.

[8] Ibid., 7. This figure is also approximately same as he SSKPof most modern surface based air defence systems. The reliability and availability factors are also similar to those normally used for air assets availability.

[9] S Rashid Naim, "Aadhi Raat Ke Baad (After Midnight)", in *Nuclear Proliferation in South Asia: The Prospects for Arms Control*, ed, Stephen Philip Cohen (Boulder, C.O.: Westview press, Inc., 1991), 31.

[10] L W McNaught, *Nuclear Weapons and Their Effects* (London: Brassey's Publishers Ltd., 1984), 26.

[11] Kemp, 15.

[12] Ibid., 15.

[13] Samuel Glasstone and Philip J. Dolan, ed., *The Effects of Nuclear Weapons* (Washington, D.C.: United States Department of Defense and United States Department of Energy, 1977), 37.

[14] Naim, 23-61. See for a detailed study of the areas of homeland affected in the case of ground burst nuclear attacks on military targets in an Indo-Pakistani scenario.

[15] Glasstone and Dolan, 80-81.

[16] Ibid., 541-618.

[17] Naim., 28.

[18] Galsstone and Dolan, 100-115. The calculations are based upon the data and scaling law as given in this book. According to the book the altitude effects for airbursts up to 5000 feet are negligible as the atmospheric parameters can be considered to be constant.

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